



TGU-ECON Discussion Paper Series
#2018-5

GDP Announcements and Stock Prices

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July 2018

GDP ANNOUNCEMENTS AND STOCK PRICES^{*}

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July 25, 2018

Abstract

Timely GDP announcements seem to be a useful approach to communicate immediate macroeconomic conditions, but inaccuracy might instead trigger financial market turmoil. This study examines the stock market response to GDP announcements in Japan and provides several insights into the tradeoff between timeliness and accuracy. First, the effect of the initial GDP announcement on stock price is tenuous at best, suggesting little useful information in the provisional estimates. Second, the stock market responds keenly to the first revision, but little to the second revision. Finally, depending on the expenditure components of GDP, the revisions cause over- and under-reactions, and are thus different destabilizing factors in stock prices.

Keywords: GDP announcements, Data revisions, Stock prices

JEL Classification: C58, E44, G14

^{*}Funashima and Ohtsuka's research was supported financially by a Grant-in-Aid for Scientific Research by the Japan Society for the Promotion of Science (No. 17K03770). The usual disclaimers apply.

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1 Introduction

Economic agents change their decisions as new information about the state of the economy comes to light. In macroeconomic terms, quarterly GDP estimates are one of the most important pieces of real-time information and receive considerable attention from many agents. However, they are revised significantly on several occasions after the initial announcement of the provisional estimates. If quarterly GDP estimates are updated with more precision, then we would expect that economic agents will change their behavior in response to the informational content of the revisions.

Since Mankiw *et al.* (1984) and Mankiw and Shapiro's (1986) influential papers, a central issue in the discussion of GDP announcements in the literature is whether the revisions are news or noise. In this context, news means that revisions have new information available only after the announcement, while noise means that early GDP estimates include a measurement error that is uncorrelated with the revised estimates. The news view suggests that GDP revisions could lead economic agents to make adjustments in their optimal choices in real time.

In spite of these concerns, there is little systematic evidence of the potentially negative aspects of early releases of provisional estimates. On the one hand, early announcements of quarterly GDP estimates are thought to have the beneficial role of communicating information about immediate macroeconomic conditions. On the other hand, if revisions to the early release are sizable, prompt but provisional announcements could be rather harmful to economic stability. The initial announcements and revisions appear to influence financial markets, which are sensitive to public information in particular. Specifically, Beaudry and Portier (2014) find that stock prices reflect economic agents' information and they are the first variable to move in response to news. However, we are far from a satisfactory understanding of how GDP revisions affect the market. Unlike the efficient-market hypothesis in Fama's (1970) influential work, recent papers argue that stock prices never absorb news shocks perfectly and immediately, implying the possibility that GDP announcements cause market turmoil.

In this study, we evaluate the stock market response to GDP announcements. Specifically, we use exogenous variables of revisions to GDP announcements to investigate how the stock market responds to new information about previous economic activities in Japan. To this end,

we use a comprehensive data set provided recently by Iizuka (2017), who compiles real-time data on Japan's GDP and its components in the current system introduced after August 2002. To quantify the effect of GDP announcements on stock prices, we control the changing volatility of stock prices by employing a stochastic volatility (SV) model in which we also account for the relevant control variables.

Our dataset on the quarterly GDP estimates is useful for several reasons. First, it includes two major revisions in Japan. We require the release-based approach to capture changes in expectations in the market. Second, as Iizuka (2017) shows, most of the revisions to GDP and its demand constituents are news rather than noise. The strong exogeneity of the revisions is crucial for measuring the causal effect on the market. Moreover, we can regard the revisions data as a source of exogenous variation in the business cycle and its demand factors. This implies that we can identify the effects of major macroeconomic variables on stock prices.

We contribute to the literature by demonstrating that early releases of the quarterly GDP estimates do not necessarily lead to the desired outcomes. In other words, the initial releases of the quarterly GDP estimates are less useful to communicate with the stock market than generally thought. Rather, we show that the revisions cause market turmoil due to over- and under-reactions. Moreover, in contrast to the previous literature, we show that the expenditure components of GDP have dramatically different effects on expectations. Much of the recent literature focuses on expectational changes due to the arrival of a particular type of news. This includes, among others, the news-driven business cycle model (Beaudry and Portier, 2004, 2005, 2006), which explains booms and recessions by people's speculations of the future and their errors; that is, the anticipated demand increase in the future causes a boom, and demand that falls short of expectations causes a recession. This suggests that demand revisions are procyclical. However, our results show that demand revisions are not necessarily procyclical, depending on the expenditure components of GDP.¹

To be more precise, we summarize our main findings as follows. First, the initial release of quarterly GDP estimates is less likely to impact stock prices. This finding denies the role of the initial release in communicating with the market. In contrast, the first revision has a substantial

¹Note that, unlike the news-driven business cycle approach, GDP revisions are news about the previous macroeconomic conditions. For details about news-driven business cycles, see Beaudry and Portier (2014).

and transient positive effect on stock prices. The second revision is no longer a significant driving force in stock prices, probably because economic agents are indifferent to information in the distant past.

We also find that, depending on the expenditure components of GDP, the revisions cause over- and under-reactions, thus becoming destabilizing factors in stock prices. For example, the market response to revisions to private and public expenditures differs quantitatively. Quantitatively, announcements about private demand lead to market fluctuations, while those on public demand have relatively small impacts overall. This difference suggests that the market looks at private economic activities, rather than public ones. Moreover, revisions to consumption and investment have opposite effects on the market. Revisions to consumption in both the private and public sectors are countercyclical, whereas those to private investment are procyclical, possibly due to intertemporal consumption-savings decisions. Finally, revisions to exports are procyclical and those to imports are countercyclical.

1.1 Related literature

GDP revisions

Our study is related to the literature on the properties of GDP revisions.² Within this literature, one of the most closely related works is that of Faust *et al.* (2005), who characterize GDP revisions in the G-7 industrialized countries, which includes Japan.³ In the Japanese case, Faust *et al.* (2005) provide evidence in favor of the noise view that the initial announcement can predict the bulk of the revisions. We should note, however, that the sample period is from 1970:Q1 to 1997:Q4 and covers the previous system of quarterly GDP estimates.

Only recently did Iizuka (2017) construct data on the current system and support the news view using a seasonally adjusted series. In other words, at least in the current system, early

²Our paper is part of a growing body of literature on real-time data analysis, including GDP announcements. Since the pioneering work by Gartaganis and Goldberger (1955), many researchers have conducted various real-time data analyses. In the literature, many studies provide detailed examinations of forecasts based on real-time data or the effects of data revisions on forecasts (e.g., Croushore and Stark, 2001; Sinclair and Stekler, 2013; Liebermann, 2014; Galvão, 2017). In a related work, Orphanides and van Norden (2002) study how data revisions affect real-time estimates of output gaps. See, for example, Croushore (2011) for a survey of real-time data analysis.

³For further studies, see, for example, Patterson and Heravi (1991) for the United Kingdom and Aruoba (2008) for the United States.

announcements cannot predict the revisions, and economic agents receive fresh information when revisions are released.⁴

It is worth noting that, except for Casares and Vázquez (2016), none of these previous works reveal the effects of such GDP revisions.⁵ Casares and Vázquez (2016) use a dynamic stochastic general equilibrium model to estimate the effects of data revision shocks on business cycle fluctuations in the United States, and find that GDP and inflation revisions are procyclical, whereas consumption revisions are countercyclical. An important note here is that Casares and Vázquez (2016) consider only a revision from initial to final estimates. Final GDP estimates are obtained after multiple rounds of revisions; disregarding intermediate revisions between initial and final estimates could yield biased results. Given this view, this study adopts the release-based approach.

Stock price dynamics

There is a wide range of views about the sources of stock price dynamics. It is necessary to control for the various determinants to characterize the stock market response to GDP announcements. The primary factor is economic fundamentals; that is, the stock market reflects principal macroeconomic variables. For example, both foreign and domestic factors influence the stock market, including business cycles, interest rates, and the monetary base (e.g., Fama, 1981; Campbell and Shiller, 1988; Balvers *et al.*, 1990).

According to the efficient-market hypothesis, if the market is frictionless, then stock prices fully and immediately reflect all available information about firms (Fama, 1970). A host of recent evidence counters this hypothesis, especially after the 2000s. Within this literature, researchers detect over- and under-reactions in the market in response to news. Such market behaviors are well documented by Chan (2003), Tetlock (2010), Savor (2012), and Frank and Sanati (2018), among others. To the best of our knowledge, this is the first study to provide evidence of how stock prices respond to new information accompanied by GDP announcements.

In addition, our work is related to the recent literature on the relationship between economic

⁴The initial announcements of quarterly GDP estimates in the current system are released one month earlier than in the previous system, in which the initial announcements correspond to the timing of second announcements (first revisions) in the current system.

⁵While beyond the scope of the present study, Hüning (2017) examines the impact of monetary policy on asset prices, with special focus on Swiss National Bank communication.

policy (or political) uncertainty and stock prices (e.g., Pástor and Veronesi, 2012, 2013). Prior studies show a negative link between stock prices and economic policy uncertainty and political uncertainty.

From the perspective of empirical modeling, our approach builds on well-established SV models for modelling stock price dynamics. Researchers have long acknowledged that time-varying volatility is inherent in the changing rate of stock prices, and we must therefore consider such time-series characteristics.

2 Empirical framework

2.1 Data description

We use monthly observations for the period from January 2003 to July 2015, which is restricted due to the availability of quarterly GDP estimates in Japan’s current system. We draw the seasonally adjusted series of GDP announcements in our analyses from Iizuka (2017), who provides a dataset of initial estimates, first revisions, and second revisions.

The initial estimates are released about one and a half months after the end of the quarter (i.e., February, May, August, and November in each year). The first revisions are released about a month after the initial estimates (i.e., March, June, September, and December in each year), and the second revisions are released approximately half a year to one year and three months after the first revisions based on the estimates published annually in December. Specifically, the second revisions pertaining to Q2-Q4 in the previous year and Q1 in the reference year are disclosed publicly in December of the reference year. We use the series of Q1 in the reference year as the data for second revisions, since market participants are more concerned about economic trends in the reference year than in the previous year.⁶ When releasing the GDP estimates, Japan’s Cabinet Office provides the headline numbers as well as estimates of each of the major expenditure components of GDP. Our dataset includes these GDP components.⁷ We obtain the

⁶In the robustness check, we use the series of Q2-Q4 in the previous year.

⁷In the first revisions, as Iizuka (2017) points out, private investment has the largest revisions in terms of mean absolute error. This is because the “Financial Statements Statistics of Corporations by Industry” is released after the initial estimates. The first revision is based on the statistics covering the business activities of corporations in Japan. Incidentally, in the second revisions, public investment is the largest amount by mean absolute error.

series of stock prices as the rate of change of the Nikkei 225 Average Index available in the Federal Reserve Bank of St. Louis database. We plot these data in Figure 1.

[Insert Figure 1 around here]

The baseline specification includes, unless otherwise noted, the following 10 control variables that are considered fundamentals of the Japanese economy: leading diffusion index (DI), economic policy uncertainty (EPU), global EPU, political uncertainty, bond yield, monetary base, export, exchange rate, the global financial crisis (GFC) dummy, and the Great East Japan Earthquake (GEJE) dummy.⁸ The leading DI is considered a business condition and positively related to stock prices. We include EPU, global EPU, and political uncertainty to reflect the findings of a strand of recent literature (e.g., Pástor and Veronesi, 2012, 2013; Baker *et al.*, 2016) that show a negative relationship between these types of uncertainty and stock prices. We expect a negative correlation between bond yields and stock prices. Here, we use long-term government bond yields (10-year). As an indicator of monetary policy in Japan, we use the rate of change of the monetary base. Moreover, as external factors, we use exports and the exchange rate (yen/U.S. dollar). A visual inspection of stock prices in Figure 1 shows clear negative spikes around the global financial crisis and the Great East Japan Earthquake. Hence, the GFC dummy takes a value of 1 in October 2008 and 0 otherwise, and the GEJE dummy takes a value of 1 in March 2011 and 0 otherwise.

2.2 Empirical model

In this subsection, we present the linear systems to estimate the time-varying behavior of the volatility in stock prices and the marginal effects of macroeconomic variables. Let y_t denote the endogenous variable y and k , the exogenous variable x at time t . The simple linear regression model for the n observation of y (denoted by y_t for $t = 1, \dots, n$) and x (denoted by x_t for

⁸The leading DI is available from the website of Japan's Cabinet Office. All series of uncertainty are available from <http://www.policyuncertainty.com/>. The political uncertainty index is that used in Arbatli *et al.* (2017). The series of long-term government bond yields (10-year) and exchange rates are available from the Federal Reserve Bank of St. Louis database. Monetary base and real export data were taken from the Bank of Japan's website.

$t = 1, \dots, n$) is

$$y_t = x_t\beta + \epsilon_t, \quad \epsilon_t \sim \mathcal{N}(0, \sigma_t^2), \quad (1)$$

where β is the slope parameter vector. Suppose that the dependent variable y_t in equation (1) refers to the monthly growth rate of the stock price. Further, suppose that the independent variables x in equation (1) are GDP announcements and the control variables mentioned above. The initial announcement variable is lagged one month to mitigate simultaneity bias because the initial variable is endogenous, unlike the revision variables. Except for the GFC and GEJE dummy variables, all control variables are one lag of each of these to address endogeneity.

In this study, we assume that the time-varying structure of the variance of error term is the SV process. Many studies apply the SV model for empirical analyses in financial economics. We consider the following SV process:

$$h_t = \omega + \phi(h_{t-1} - \omega) + \eta_t, \quad \eta_t \sim \mathcal{N}(0, \sigma_h^2), \quad (2)$$

where h_t is the unobserved log volatility ($h_t = \log \sigma_t^2$). ϕ is the autoregressive parameter. η_t follows the normal distribution such that the mean and variance are zero and σ_h^2 . After introducing the SV process, it is difficult to evaluate the likelihood function of the model. Thus, we take a Bayesian inference with the Markov chain Monte Carlo (MCMC) method to estimate the parameters.

To simplify the notation, let $y = \{y_t\}_{t=1}^n$, $x = \{x_t\}_{t=1}^n$, $\vartheta = (\beta, \omega, \phi, \sigma_h^2)$ and $h = (h_1, \dots, h_n)$. Given ϑ and h , the conditional likelihood is

$$L(y|\vartheta, h, x) = \prod_{t=1}^n \frac{1}{\sqrt{2\pi}} \exp \left[-\frac{h_t}{2} - \frac{(y_t - x_t\beta)^2}{2 \exp(h_t)} \right]. \quad (3)$$

2.3 MCMC algorithm

As in many prior studies, we illustrate the estimation procedure using the MCMC algorithm. Since we adopt a Bayesian approach, we complete the model by specifying the prior distribution

over the parameters. Thus, we apply the following prior distribution:

$$p(\vartheta, h) = p(\beta)p(\sigma_h^2)p(\omega)p(\phi)p(h|\omega, \phi, \sigma_h^2),$$

with

$$\beta \sim \mathcal{N}(\beta_0, \Sigma_{\beta_0}), \quad \omega \sim \mathcal{N}(\omega_0, \Sigma_{\omega_0}), \quad \phi \sim \mathcal{TN}(\phi_0, \Sigma_{\phi_0})I[S(\phi)], \quad \sigma_h^2 \sim \mathcal{IG}(\lambda_0, \tau_0^2),$$

where $\mathcal{TN}$ and $\mathcal{IG}$ denote the truncated normal and inverse gamma distribution, respectively. Then, $I(\cdot)$ is the indicator function that takes a value of 1 if the condition in parentheses is satisfied, and 0 otherwise. $S(\phi)$ is the set of parameters that satisfy the stationary condition.

Given the prior distribution and the likelihood function in (3), we can write the joint posterior distribution as:

$$p(\vartheta, h | y, x) \propto p(\vartheta, h)L(y|\vartheta, h, x). \quad (4)$$

We must use multiple integration to evaluate the marginal posterior distributions of the parameters and latent variables when using the joint posterior distribution (4). It is difficult to solve the marginal posterior distribution if the joint posterior distributions are complicated; thus, we sample the parameters from the full conditional distribution of the parameter using the MCMC method, which is an algorithm that utilizes Markov sampling and Monte Carlo integration to approximate the full conditional distribution. Thus, we draw the random samples from the full conditional distributions for the model, as follows:

1. Initialize ϑ and h .
2. Draw $\beta | \omega, \phi, \sigma_h^2, h, y, x$.
3. Draw $h | \beta, \omega, \phi, \sigma_h^2, y, x$.
4. Draw $\omega | \beta, \phi, \sigma_h^2, y, x$.
5. Draw $\phi | \beta, \omega, \sigma_h^2, h, y, x$.
6. Draw $\sigma_h^2 | \beta, \omega, \phi, h, y, x$.
7. Go to 2.

We can implement the sampling scheme of a normal linear regression for steps 2, 4, and 6. For step 5, we employ the Metropolis-Hastings algorithm, as proposed by Chib and Greenberg (1995). For step 3, we utilize a multi-move sampler, as in Watanabe and Omari (2004).

3 Empirical results

We conduct the MCMC simulation by generating 45,000 draws and discarding the first 30,000 draws as the initial burn-in.

3.1 Simultaneous evidence

Table 1 displays results for GDP announcements from estimating the SV model above. The table shows the posterior means, the standard deviations, and 95% credible intervals, according to which the posterior mean of the initial announcement is around 0.167, but the credible interval contains 0. This suggests that the initial announcement has little new information about the economic fundamentals in the previous quarter. In contrast, the posterior mean of the first revision is positive and sizable, around 7.077, indicating that market participants are very sensitive to the first revision of headline information. The second revision has no impact on stock prices.

[Insert Table 1 around here]

The estimation results for the control variables in Table 1 seem plausible overall. We can confirm the positive effects in the results for leading DI, monetary base, and export, whereas we find negative effects according to EPU and global EPU. The effects of political uncertainty, bond yields, exchange rate are ambiguous. Not surprisingly, the results suggest GFC and GEJE have large negative effects on the stock prices. Table 1 also reports the three SV parameters ω , ϕ , and σ_h^2 . All of the 95% intervals are larger than 0. The posterior means of the autoregressive parameter, ϕ , is 0.547, and the persistency of the volatility shocks is moderately high.

[Insert Table 2 around here]

Turning now to the key expenditure components of GDP, Table 2 reports how each component has different effects in terms of market participants' responses to the announcements. Note

that the estimation includes the same set of control variables as in the SV model. The revision results for private demand in Panel A of Table 2 confirm the somewhat ambiguous effects of private consumption, whereas we see positive effects from private investment in both the first and second revisions. Panel B of Table 2, which reports the case of public demand, shows that the first revision of public consumption has a positive impact on stock prices. In contrast, the first revision of public investment has a negative effect. Regarding external demand, Panel C of Table 2 shows that the first revision of export and import yields opposite effects.⁹

3.2 Dynamic evidence

As we mentioned above, it is possible that stock prices do not necessarily absorb the news shocks of GDP announcements instantaneously. The collective empirical evidence points to the possibility of over- and under-reaction in stock prices when news shocks arise. If this is the case, it is not sufficient to measure only the simultaneous effects.

Thus, in the next step, we examine the dynamic effects of GDP announcements on stock prices. To this end, we now construct the dependent variable as the average rate of change in stock prices over time. In other words, the dependent variable is now the average percentage increase over a δ -month horizon, such that $y_t^\delta \equiv \frac{1}{\delta} \sum_{s=1}^{\delta} y_{t+s-1}$. When estimating the SV model, the GFC dummy takes a value of 1 if y_t^δ includes the value for October 2008 and 0 otherwise, and the GEJE dummy takes a value of 1 if y_t^δ includes the value for March 2011 and 0 otherwise.

[Insert Figure 2 around here]

Figure 2 shows the results for headline GDP announcements. The horizontal axis is time horizon in months, δ . In this figure, we report the posterior means (solid line) together with the 95% credible intervals (dashed line). We see that the initial announcement effects are negligible over time. The positive effect of the first revision is large, but not persistent. A weak reversal follows the instantaneous response, suggesting a stock market overreaction. The second revision seems to have small negative impacts after a 3-4 month delay.

⁹The results for the initial announcement of external demand could be due to (albeit slight) overreaction because the initial variables are lagged by one month.

[Insert Figure 3 around here]

Figure 3 illustrates the results for private demand. Overall, stock prices tend to be relatively insensitive to the initial release, whereas the revisions cause volatility in the stock market. Panel A of this figure indicates that the negative response of stock price to the first revision in private consumption is strong and persistent. This indicates a stock market underreaction to private consumption news. The second revision effect appears small for all horizons. On the other hand, the first and second revisions of private investment in Panel B have positive impacts in a short time horizon. It is noteworthy that private investment exhibits reversals following the first revisions, such that we observe a relatively small and negative response after 3-5 months. We interpret this reversal as evidence of an overreaction to the news about the first revisions of private investment.

[Insert Figure 4 around here]

Figure 4 plots the results for public demand. The effects of public demand are smaller than those of private demand overall. This smaller role of public demand is consistent with Hiraga *et al.* (2018), who point out that public infrastructure investment does not explain stock returns adequately in Japan. Furthermore, compared to private demand, the initial release, rather than the revision, has larger effects on stock prices for public demand. With respect to revisions, we find a negative response in public consumption (Panel A), while we cannot see a clear response in public investment (Panel B). A common denominator in private and public demand is the countercyclical behavior of stock prices to their consumption news.

[Insert Figure 5 around here]

Finally, Figure 5 presents the results for external demand. In both exports and imports, the initial announcement responses appear insignificant. The results of exports in Panel A show persistent, positive moves in stock prices in response to the first revision. In the first revision, we find an obvious underreaction, leading to drifts over the next 4-5 months. The second revision has smaller effects on the market. We can see the opposite results for the import announcement (Panel B).

3.3 Robustness

We now present several robustness checks for our results.

The first robustness check assesses the impact of the second revisions. Our main specifications of the second revisions use the revised values in the first quarter. Although precise information about recent economic circumstances is relevant to market participants, they may also consult the revised values for the previous quarters. Our dataset also includes the second revisions of the second to fourth quarters (Q2-Q4) in the previous year, which enables an average-based strategy in which the quarterly average of the past year (from Q2 in the previous year to Q1 in the released year) is used.

[Insert Table 3 around here]

Table 3 reports the results for the simultaneous parameters of the GDP announcements. The upper panel of this table focuses on the headline case, while Panels A-C show the components case. The results for the initial announcements and first revisions are very similar to those in Tables 1 and 2. The results for the second revisions are similar as well, although we find a larger negative effect in the private consumption case.

In the second robustness check, we explore the potential problem of over-specification. Until this point, all specifications include the 10 control variables we described above. However, in some cases, the credible interval of several control variables contains 0. To address this issue, we conduct additional estimations to ensure that excluding irrelevant control variables does not unduly affect the results above. The estimated effects of GDP announcements (unreported) are less sensitive to this exclusion. Incidentally, our results are robust to excluding the GFC and GEJE dummy variables, since the SV specification arguably controls these shocks to stock prices.

4 Conclusion

When releasing quarterly GDP estimates, there is a tradeoff between timeliness and accuracy. By examining the stock market response to GDP announcements in Japan, we demonstrate that timeliness is of slight importance. To be precise, our results suggest that the preliminary

estimates (initial announcements) have a less pronounced effect on the timely evaluation of economic trends. A possible reason for this is that market participants can find the trends through releases of forecasts by private economic institutions and other fundamentals, which we reflect in our control variables. On the contrary, the revisions (notably the first one) provide new information for market participants, and the revisions make stock prices volatile.

Moreover, in contrast to prior research, we find that revisions to the expenditure components of GDP have dramatically different effects on expectations. We show that demand revisions are not necessarily procyclical depending on expenditure components of GDP. For example, revisions to consumption in both the private and public sectors are countercyclical, whereas those to private investment are procyclical, possibly due to intertemporal consumption-savings decisions.

We view this study as the first attempt to examine how GDP estimates should be released in terms of stock market stability. However, there is currently little research on the effects of GDP announcements on the real economy. Future work could investigate whether GDP announcements affect the real economy through the stock market and other channels. Extended research is required to propose desirable GDP announcements.

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Table 1: Effect of GDP revisions on stock prices

	Mean	SD	95%CI	
const.	-1.644	0.268	-2.177	-1.117
Initial announcement	0.167	0.169	-0.162	0.500
First revision	7.077	0.540	6.014	8.158
Second revision	0.053	0.458	-0.850	0.949
<i>Control variables</i>				
Leading DI	0.050	0.005	0.041	0.059
EPU	-0.032	0.005	-0.042	-0.023
Global EPU	-0.052	0.005	-0.062	-0.042
Political uncertainty	-0.004	0.009	-0.022	0.015
Bond yield	-0.470	0.847	-2.133	1.177
Monetary base	0.011	0.005	0.000	0.022
Export	0.102	0.033	0.036	0.167
Exchange rate	0.043	0.044	-0.043	0.130
GFC dummy	-15.023	1.388	-17.729	-12.304
GEJE dummy	-8.739	0.991	-10.695	-6.796
<i>SV parameters</i>				
ω	0.483	0.175	0.144	0.827
ϕ	0.547	0.017	0.528	0.594
σ_h^2	0.973	0.112	0.776	1.216

Note: Mean, SD, and 95%CI represent the posterior mean, the standard deviation, and 95% credible interval, respectively.

Table 2: Effect of GDP component revisions on stock prices

A. Private demand								
	Private consumption				Private investment			
	Mean	SD	95%CI		Mean	SD	95%CI	
Initial announcement	1.074	0.176	0.734	1.422	0.518	0.066	0.388	0.648
First revision	0.480	1.201	-1.869	2.859	0.925	0.073	0.780	1.068
Second revision	-1.492	0.673	-2.823	-0.166	1.805	0.269	1.279	2.327
B. Public demand								
	Public consumption				Public investment			
	Mean	SD	95%CI		Mean	SD	95%CI	
Initial announcement	3.991	0.340	3.324	4.647	-0.864	0.054	-0.970	-0.759
First revision	1.835	0.749	0.368	3.319	-0.467	0.141	-0.748	-0.191
Second revision	0.563	0.529	-0.478	1.591	-0.045	0.081	-0.205	0.112
C. External demand								
	Exports				Imports			
	Mean	SD	95%CI		Mean	SD	95%CI	
Initial announcement	-0.278	0.034	-0.344	-0.213	0.473	0.055	0.363	0.581
First revision	3.289	0.365	2.579	4.001	-3.697	0.339	-4.359	-3.031
Second revision	0.999	0.197	0.610	1.385	-0.376	0.319	-1.005	0.254

Note: Mean, SD, and 95%CI represent the posterior mean, the standard deviation, and 95% credible interval, respectively.

Table 3: Robustness checks using quarterly average of second revisions

	GDP							
	Mean	SD	95%CI					
Initial announcement	0.161	0.153	-0.135	0.464				
First revision	7.243	0.537	6.195	8.315				
Second revision	-2.486	1.155	-4.803	-0.255				
A. Private demand								
	Private consumption				Private investment			
	Mean	SD	95%CI		Mean	SD	95%CI	
Initial announcement	1.085	0.172	0.752	1.421	0.587	0.065	0.458	0.713
First revision	-1.215	0.951	-3.086	0.654	0.811	0.072	0.668	0.949
Second revision	-5.323	1.385	-8.046	-2.635	1.679	0.405	0.880	2.476
B. Public demand								
	Public consumption				Public investment			
	Mean	SD	95%CI		Mean	SD	95%CI	
Initial announcement	3.843	0.332	3.194	4.493	-0.920	0.054	-1.025	-0.813
First revision	2.218	0.796	0.667	3.781	-0.563	0.142	-0.842	-0.282
Second revision	1.515	0.968	-0.371	3.397	-1.261	0.238	-1.730	-0.797
C. External demand								
	Exports				Imports			
	Mean	SD	95%CI		Mean	SD	95%CI	
Initial announcement	-0.257	0.033	-0.321	-0.193	0.488	0.053	0.383	0.592
First revision	3.398	0.388	2.640	4.159	-3.694	0.341	-4.366	-3.028
Second revision	1.906	0.467	0.986	2.829	-0.571	0.581	-1.723	0.568

Note: Mean, SD, and 95%CI represent the posterior mean, the standard deviation, and 95% credible interval, respectively.

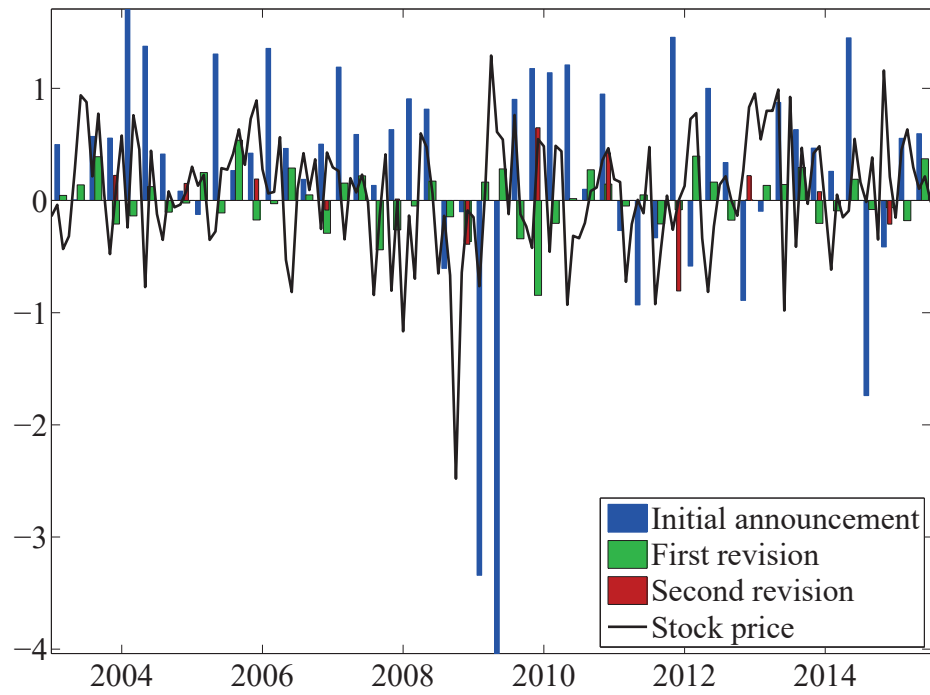


Figure 1: GDP announcements and the rate of change of stock prices.

Note: For comparison, the rate of change of stock prices is multiplied by 0.1.

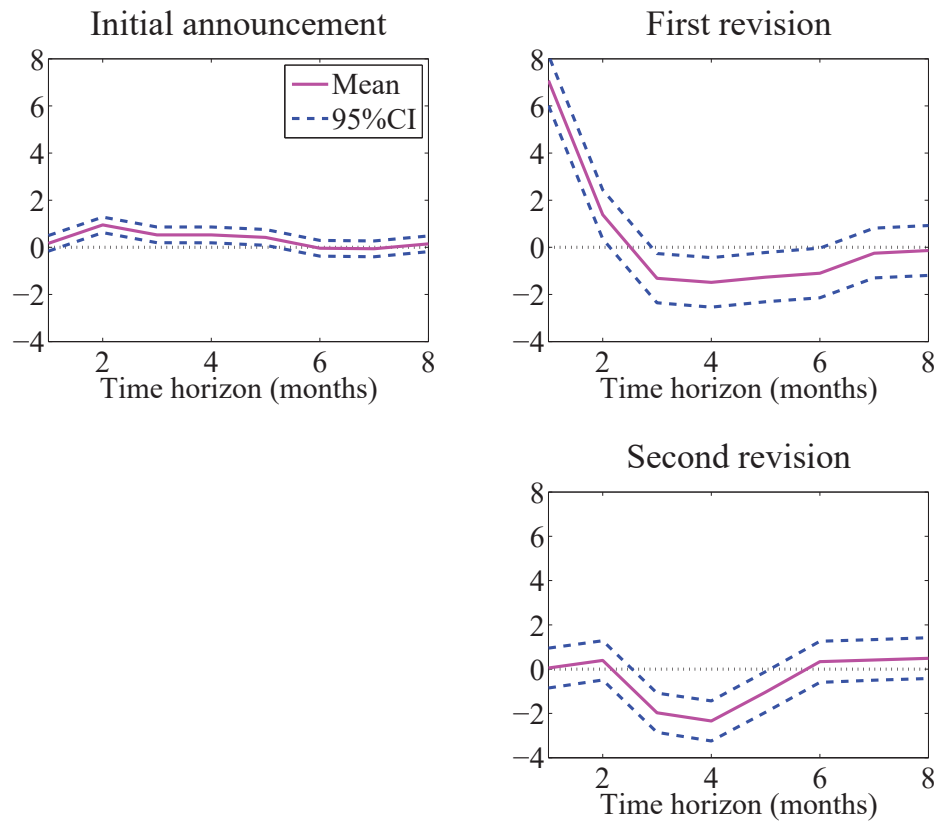


Figure 2: Effects of GDP announcements on stock prices.

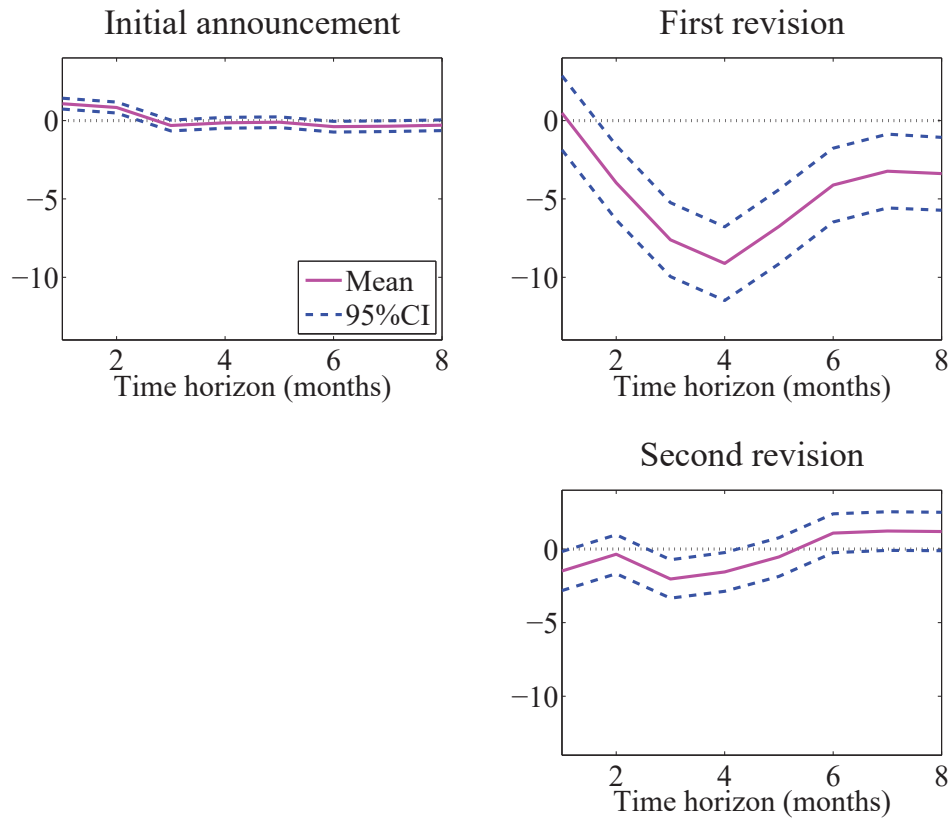
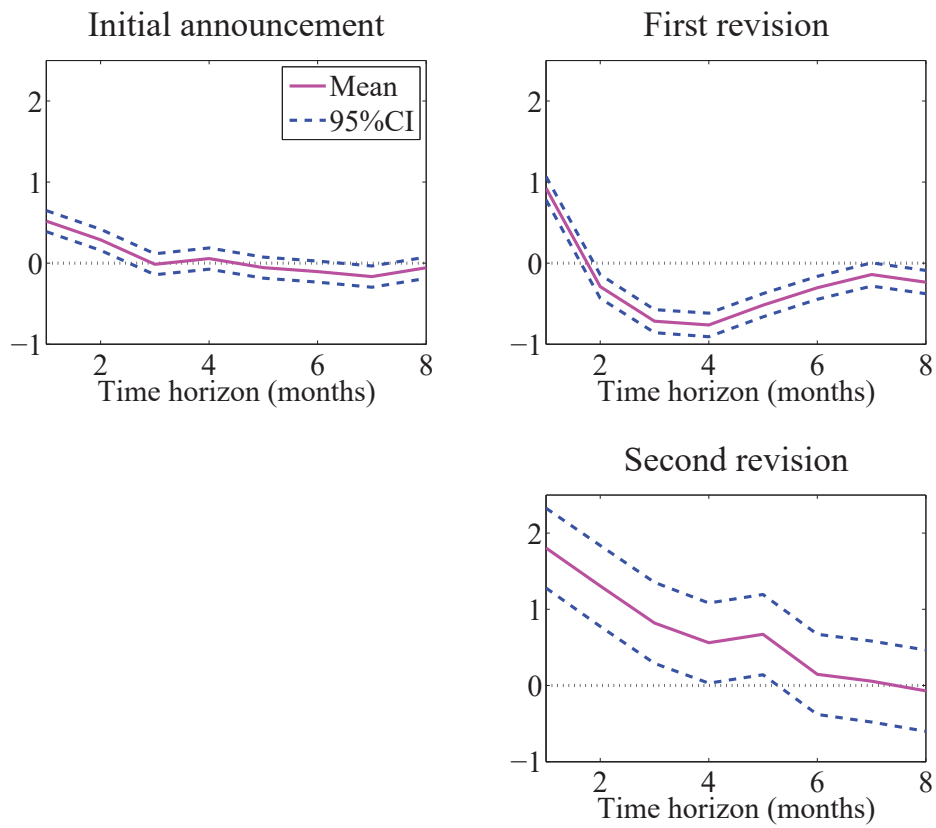
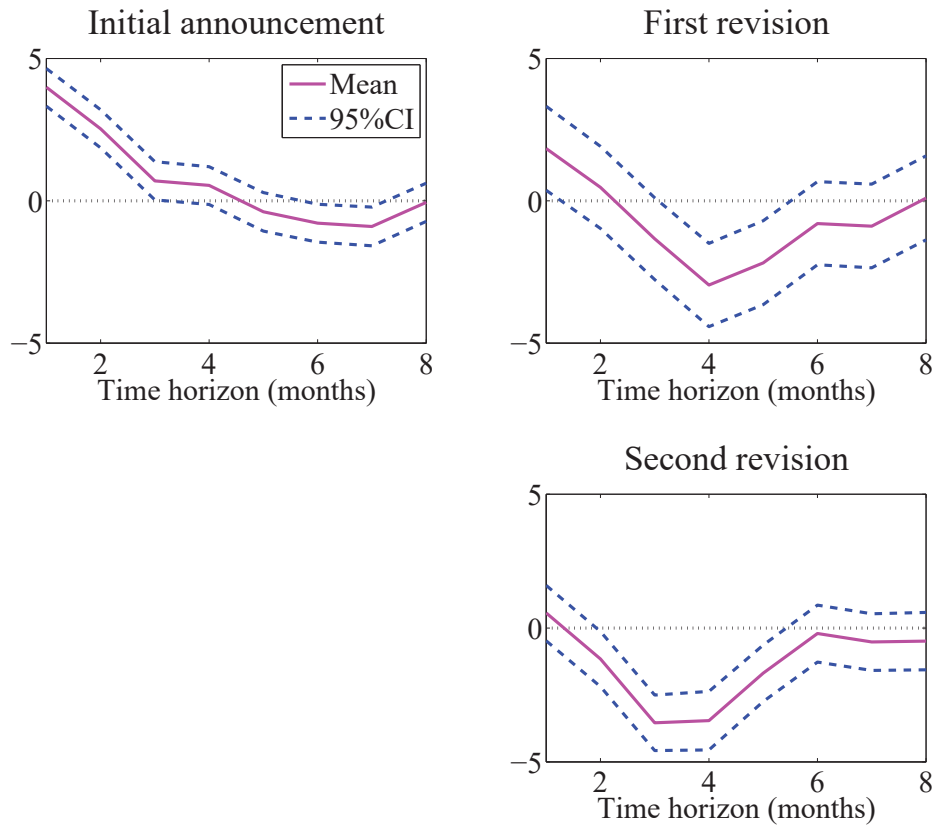
A**B**

Figure 3: Effects of private component announcements on stock prices. (A) Private consumption. (B) Private investment.

A



B

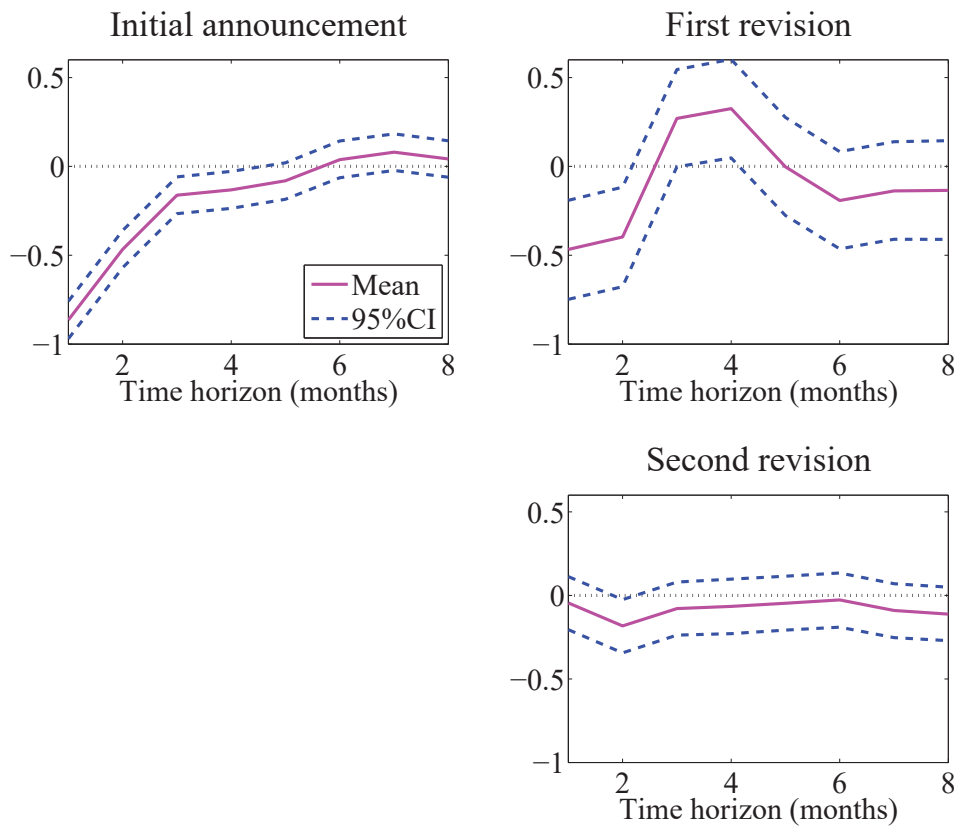
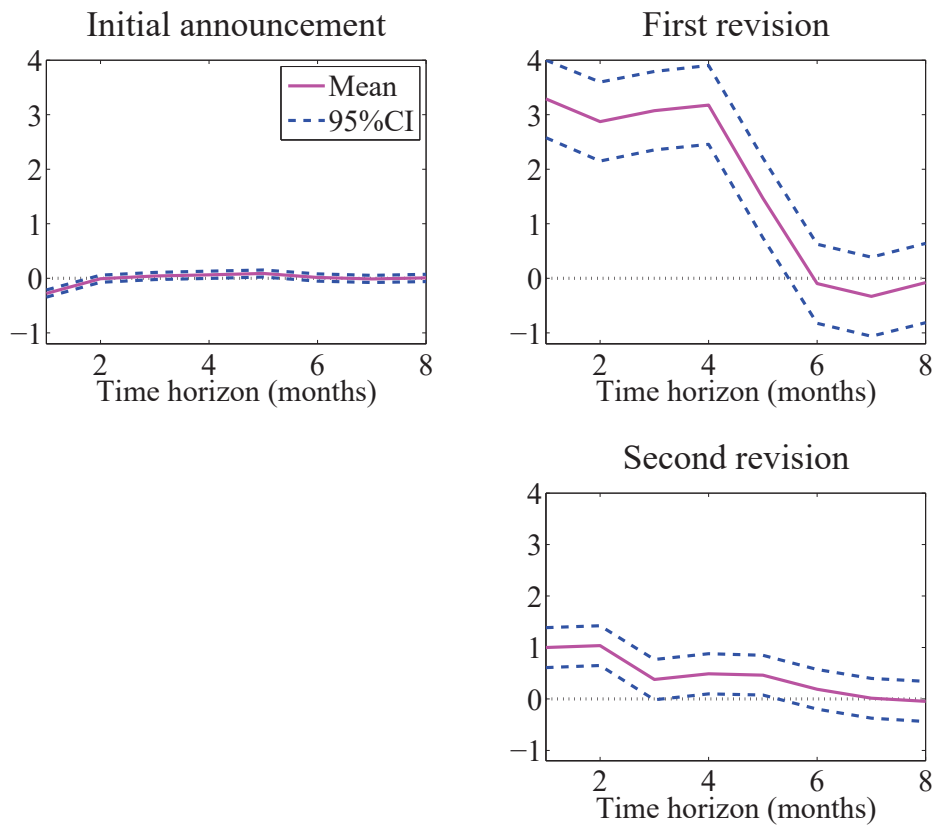


Figure 4: Effects of public component announcements on stock prices. (A) Public consumption. (B) Public investment.

A



B

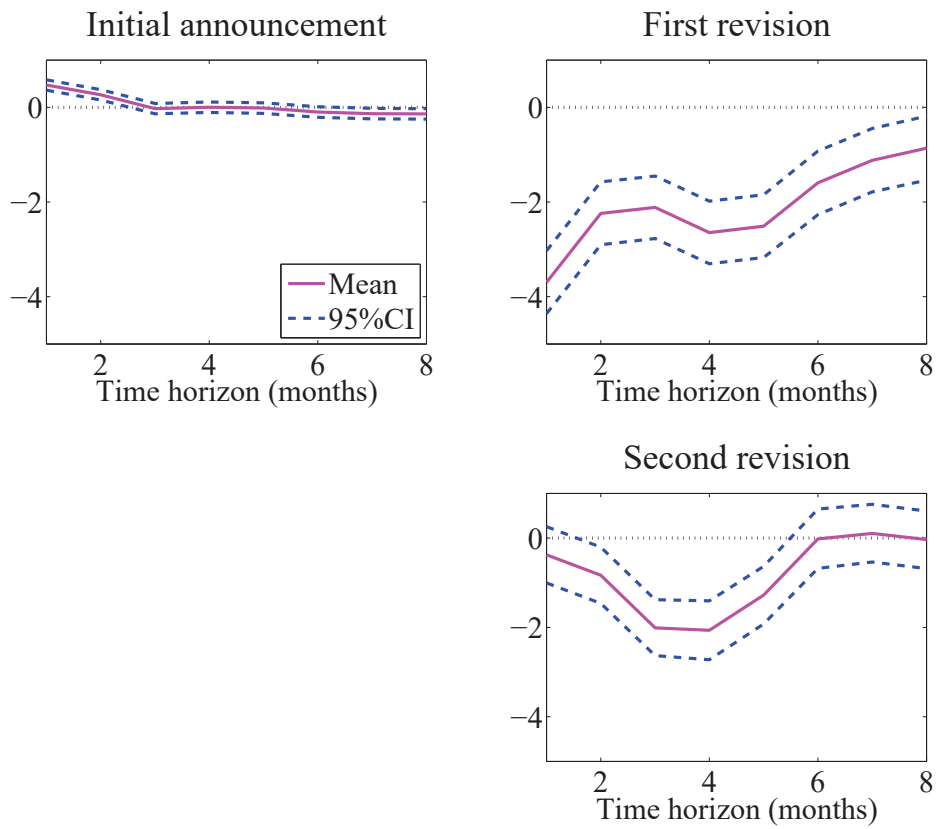


Figure 5: Effects of external component announcements on stock prices. (A) Exports. (B) Imports.